

# LETTERS

## RECHARGEABLE H.T. BATTERY

May I comment on Mr Pash's letter concerning the Milnes rechargeable h.t. battery.

This was first produced in the late 1920s by the Milnes Radio Company of Yorkshire. The cells were nickel-cadmium type with alkaline potassium hydroxide electrolyte, producing a potential when charged of about 1¼V. All the cells were connected in series to give 120V for normal operation; but could be connected in a series-parallel arrangement with a built-in switch, so that the unit could be recharged from a normal 6V battery charger.

Unlike lead-acid accumulators, nickel-cadmium cells can survive to a ripe old age and it is very interesting to learn that the unit Mr Pash has found bears this out. The makers at the time claimed that they were 'virtually indestructible'.

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## 'CURRENT DUMPERS'

To quote Michael McLoughlan (September, p.39), "it is therefore appropriate to call the output transistors in Fig. 1 the 'current dumpers'."

The Concise Oxford Dictionary, for example, explains that "to dump" means to deposit (rubbish, etc.), to abandon, to export at a low price goods unsaleable in the country of origin. I am unable to see the claimed appropriateness of the term in the context of the article.

Could this be one of the causes of the confusion which, as Mr McLoughlan mentions, has surrounded this subject?

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## DESIGN COMPETITION

I was interested to read Mr Watson's plea (September Letters) for a 'discriminating' hearing aid, as I did some research relevant to the problem some years ago.

I wanted to find out why two ears give a good idea of the direction of sounds, and therefore the ability to discriminate, when two microphones do not. The answer is simply that the ear lobes (and to some extent the sound 'shadow' cast by the head) modify the sound in a way that the brain can interpret as direction. If one 'blanks off' the ears with one's hands, then the ability to judge direction deteriorates and, for instance, conversation in a room sounds cavernous.

I experimented with ears modelled out of Plasticene and later papier mâché, with small microphone inserts set in them. This gave quite spectacular results when listen-

ing over headphones — sounds being locatable through 360 degrees and also above the 'head'. I understand that this was first discovered by Bell Labs. in the 1930s, and is currently being re-discovered under the name of 'Hologhony'.

A hearing aid shaped like a head would take a little social adjustment (which is why I did not pursue my recording idea!), but if a microphone could be placed inside the ear 'on top' of the earpiece, thus using the effect of the ear lobes, this would work. However, the problem of avoiding feedback would be formidable. Another possibility would be to put the microphone in one ear and the earpiece in the other. Information would be 'back to front' but if the aid was always worn I expect one would soon get used to it. The other possibility is that enough directional information could be generated electronically from a small array of microphones.

Developing the idea may be a good candidate for an undergraduate project?

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Being deaf myself, I applaud Mr Watson's plea for help with hearing, but I am not clear that he has properly stated the problem.

Inability to cut out or subdue unwanted sounds is a common complaint, not necessarily linked to deafness. ITV, when recently asked to cut down the background music and effects to their productions, replied that the output was in fact well-balanced, it was the listener who was at fault.

But the inability to hear clearly when wearing a hearing aid in conditions of high ambient noise is another problem.

Cosmetically tucked behind an ear it has the inherent disadvantage of responding mainly to sounds behind the wearer, both volume and frequency in front being much reduced.

Truly did Dunlop, in the Textbook of Medical Treatment, say "in older people, the old-fashioned ear trumpet may well be found more effective".

The problem is really serious. For instance, a conversation in a bar at opening time becomes more and more difficult as the arrival of more people increases the ambient noise, and after a time can become quite impossible. This also goes for cafés, wedding receptions; in fact, anything which generates ambient noise.

I think a solution could lie in the use of the 'T' switch, which enables direct pickup by induction without the mike, from a telephone coil, or a radiating cable in suitably equipped theatres.

If your young men could devise a modern equivalent of the ear trumpet — something that picks up sound from a forward

direction, amplifies it and feeds it to a loop which could be 'heard' on the 'T' setting it would be a boon to everyone with a behind-the-ear aid.

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## HERETICS GUIDE

One year and some twenty five printed pages have finally brought Dr Scott-Murray's 'Heretic's Guide to Modern Physics' to a close. Considering that he holds a Ph.D in a physics subject it is hard to believe that he could have expected to get away with some of the things asserted there. Thus almost everyone working with oscillating systems is aware that in them energy is continually changing to and fro between kinetic and potential forms, while the total energy remains nearly constant. According to quantum mechanics the total energy of an electron bound in a hydrogen atom is quantised and therefore constant, but its kinetic energy is not. In attempting to score a point against quantum theory Dr Murray in his very first article (*Wireless World*) June 1982, p81, col 1, question and answer session) glossed over, not only the distinction between the kinetic and the total energy of the electron, but also the distinction between its angular momentum, which is quantised, and its linear momentum, which for a hydrogen atom may take a range of values that according to the uncertainty principle is inversely proportional to the mean distance of the electron from the proton, a spread thoroughly checked experimentally. Anyone indulging in such antics can hardly complain if at this point the discussion takes on 'a testiness of tone'.

Dr Murray asserted time and time again that no experiments bearing on his 'heresies' have been performed, but when faced with the results of experiments made with gamma rays from radioactive sources adopted Nelson's tactics for dealing with information he didn't wish to know about. As an aerial designer he might at least be expected to take an interest in the polar diagrams for atomic and nuclear phenomena, but when discussing the Compton effect (December 1982) he ignored this aspect of the topic completely. Nowhere does he give even a hint that the quantized angular momentum of, say, a hydrogen atom, is closely associated with the complexity of the polar diagram of any photon emission from the atom about the direction of its axis of spin. This type of association has been confirmed by many measurements on radioactive nuclei aligned at low temperatures, and by angular correlation measurements, but on the evidence of his articles the nature, interpretation, and significance of such experiments appears to be a closed book to him.

In attempting to justify the notion that microphysics is determinate in retrospect (March 1983, p 45) Dr Murray selected his example with some care. If he had considered instead the two-slit interference experiment with electrons, then there are arguments which show that an experimental arrangement which defines the slit through which any particular electron passes destroys the interference pattern on the far side of the slits. Thus coupled observations of an electron as it leaves the source and as it subsequently passes some point in the shadow zone between the geometrical images of the two slits do not make it possible to say through which slit the electron passed. The Copenhagen doctrine to which he is so bitterly opposed asserts that if you can't tell which way the electron went with the baffle and slits present you are not logically entitled to conclude that it must have travelled by the direct path if similar observations are made with the baffle removed.

In the April 1983 issue Dr Murray questioned the existence of the neutrino and of discrete energy levels in nuclei. The existence of the latter is demonstrated by the spectra of the alpha particles emitted by many of the natural radioactive elements. The fact that some of them emit groups of alpha particles with several well-defined and distinct energies was known long before he took his degrees. As for the neutrino, measurements on nuclei recoiling after beta decay show that in general the nucleus does not recoil in the opposite direction to that in which the beta particle is ejected, so that from the conservation of linear momentum some other particle must be present. The energy of decay can then split between the electron and the neutrino in any way consistent with the conservation of total energy of linear momentum, since the linear momentum of a free particle is *not* quantized. Dr Murray's statement (p.61, col. 1) that 'according to the new ideas the mechanics of everything small is also quantized' is far too sweeping. There is no space here to go into the dramatic experimental consequences of the fact that the angular momenta of all the particles concerned in beta decay are quantized, and that in beta decay parity is not conserved. Incidentally parity was not invented by the nuclear theorists (p.62, col. 3), and in fact has well defined values for the electric and magnetic field distributions generated by dipole and by loop aerials, to come back to Dr Murray's own field.

On the same page he quoted a text book account of the use of virtual processes in calculations. These processes are used according to well defined rules, and always occur in cascaded pairs the overall effect of which is to satisfy the conservation laws. If permissible virtual processes are arbitrarily omitted from a calculation the results will not in general be in agreement with experiment, demonstrating in another way that the indeterminacies of quantum theory ref-

lect the properties of the natural world, and do not simply arise from the limitations of experimental techniques.

Finally we come to Dr Murray's account of the experiments carried out by Dr Aspect and his colleagues in Paris in an attempt to resolve a clash between certain predictions of quantum mechanics and of Special Relativity. In the May letters I included a reference to their own account of their work given in *Physical Review Letters*<sup>(1)</sup>, which includes a summary of the theoretical results, such as the Bell inequality, which their experiments were designed to test, and a very clear description of the experimental arrangements, which might almost be described as classical, give or take a couple of lasers and the use of photon counters. If Dr Scott-Murray had bothered to look up that reference instead of relying on second hand accounts he would have spared himself and *Wireless World* the dubious honour of having produced the most garbled discussion of a key scientific experiment that has been seen for many years. There are indeed none so blind as those who will not see.

#### References

- (1) A. Aspect, P. Grangier, and C. Roger, *Phys. Rev. Lett.* 47(1981) 460.
- C. F. Coleman,  
Grove, Nr Wantage,  
Oxfordshire.

#### The author replies:

Mr R. J. Lamb (*WW* letters, August) says that any attempt to prove the Causality law on the lines proposed in my March '83 article must involve a circular argument. He is right, of course; that is why I followed immediately with the reminder that one cannot prove that law, nor indeed any law in physics. What I sought to do was to transfer the burden of proof, so that I would no longer be required to prove that Causality held, but instead could challenge my opponents to prove — experimentally — that it did *not* hold. Was I successful?

I go along also with James A. MacHarg (*Letters*, July) when he says that my arguments are "so shallow and superficial that they merely invite argument from the specialists of this world". (However, I wouldn't agree that they are subjective arguments; I think they are as firmly based on experimental evidence as anything else in physics, and much more firmly based than, say,  $\psi$ -waves or quarks). The problem has been to state the case and précis enough material to support it within a limit of about 30,000 words. For every paragraph that reached print in *Wireless World* there is to hand about ten times as much backing material, and if anyone wants to go deeper into specifics in a constructive spirit he will certainly be welcome.

On the other hand, Mr M. J. Niman (July) is annoyed with me for attempting to mislead your "gullible readers" by misquoting Dirac on the antimatter concept. Dirac went in for positive charge,

he says, not negative matter. But did I misquote him? What Professor P. A. M. Dirac, F.R.S., actually wrote (in the second paragraph of *Proc. Roy. Soc.* 167, p.148, 1938) was:

"Secondly, we have the [Dirac] theory of the positron — a theory in agreement with experiment so far as is known — in which positive and negative values for the mass of an electron play symmetrical roles. This cannot be fitted in with the electromagnetic idea of mass, which insists on all mass being positive, even in abstract theory."

Not much doubt about that; also the term "abstract theory" is interesting. The whole paper is greatest fun and should be prescribed reading for heretics. Mr Niman seems to have been unaware of the fanciful nature of his high priest's real views.

The purpose of my articles was not to review the sequence of argument and counter-argument that led to the establishment of the Copenhagen paradigm. That sequence is accessible in every textbook, where the student will find all the successes of current theory fulsomely recounted but only rarely, between the lines, any hint of the truth that all may not be well. He will find there no consideration of how big a photon might be, or of the structure of an electron, or of the nature of electric charge or electron spin, or of the mechanism of polarization. Adherents of the theory simply decline to discuss such matters, and seek to patronize or ridicule anyone who does. Very soon one comes to realise just how restricted the coverage of this theory is, and how little it has to say even within the field it claims to cover.

Thus Mr C. F. Coleman, who would seem to have assumed the mantle of Defender of the Faith in these columns (May, July, and now), has raised many points which show the superiority of quantum theory over the earlier, "classical" physics. Several of his points I have already dealt with, superficially I admit, in letters and in the text of the articles themselves. But I question the relevance of any of them to my heresy, since I am not advocating a return to Victorian ideas. I am merely suggesting that we should look now for a credible alternative to the quantum/wave theory, with the accent on the "credible". However, since Mr Coleman has twice provided literary reference to Dr Alain Aspect's 1981 paper (and has suggested that I did not even read it before misleading *Wireless World* readers), perhaps I had better analyse that most recent E-P-R experiment at the next level of detail as shortly as possible, from the heretical viewpoint. The following amplifies my June article.

Rather than use "annihilation" photons, which are high-energy gamma rays whose polarizations cannot be measured (why not, I wonder?), Aspect *et al* generated pairs of associated photons of visible light by means of a cascade process in the spec-

trum of calcium atoms. These photons travelled in opposite directions away from the point of generation, and their planes of polarization were measured (i.e., inferred statistically) by passing them through polarizers. The performance of each polarizer, filter and detector was measured separately, together with the losses inherent in the light-collection system; from these calibrations the statistical correlation to be expected between the photons' polarizations *as measured* could be calculated, on the assumption that the photons were polarized identically when radiated. This "prediction" is the sinusoidal curve in the second figure.

The experimental measurements fitted this "prediction" perfectly. The apparatus as a whole performed during the experiments exactly in accord with the calibrations of the two photons of any given cascade pair were closely correlated. That is what this experimental result says, and that is *all* it says. It doesn't seem to conflict with Special Relativity, or to depend upon  $\psi$ -waves, or to have to do with wave-mechanics at all. As Mr Coleman remarked, "the experimental arrangements might almost be described as classical".

Then why the fuss? I will tell you. It has got firmly into the heads of all these people that Bohr and Heisenberg were right, in that the *result of a measurement* performed on one photon of a pair must affect the *physical polarization* of its distant sibling. (A metaphysical quantity is misidentified with a physical quantity). Some weird "action", it is claimed, must pass from one detector to the other faster than the speed of light. In an attempt to rationalize this claim a number of "locally realistic theories" have been proposed, involving the assumed properties of a mythical sub-stratum of sub-physical "hidden variables". (I tell no lies: this is what our modern physics has come to). An extra-ordinarily complicated mathematical argument known as Bell's theorem, which I confess I have not bothered to understand, says that if these "hidden variables" or their equivalents existed, the result of Aspect's experiment would not be the result he actually obtained.

What Dr Aspect has reported in the paper referred to by Mr Coleman is the failure of Bell's theorem. Some people say this proves that the postulated "action" travelled through the apparatus faster than light. Dr Aspect himself did *not* say this, and neither do I. Perhaps Mr Coleman does?

Aspect's experimental result can be explained simply and naturally on classical or on slightly neo-classical reasoning. But now, *just watch* how fast a house of cards collapses! The experiment has disproved Bell's theorem, which was concerned with "locally realistic theories", which were based on "hidden variables", which were invented to support the argument of the "reduction of the wave-packet", which a specious take-it-or-leave-it consequence of

the supposed existence of " $\psi$ -waves", which in their turn were an elaboration into pseudo-scientific fantasy of an innocent speculation by a post-graduate student in 1925 . . .

Everybody nowadays should keep his Occam's razor handy. Using it, if one is not blinded by the conventional prejudice, one sees that Dr Aspect's experiment is just another nail in the coffin of the Copenhagen theory. It seemed to me that his contribution to the common weal was important enough to rate a mention, superficial though perforce it had to be, in the final article of the Heretic's Guide series. I am grateful to Mr Coleman for giving me this opportunity to explain why.

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## ELECTRIC CHARGE FROM A RADIO WAVE

I am at a loss to know whether Professor Jennison was really serious in writing this article, for the conclusions he draws from his experiment seem somewhat extended.

The experimental apparatus he describes is an electronic polyphase generator, being 8-ph or 32-ph, according to how you count the nodes. As is well known in the art, polyphase machines are associated with rotating fields, and if what is normally the stator is driven backwards at synchronous speed, its field pattern will be stationary with respect to the laboratory floor. However, apart from that being an example of relative motion, what can be deduced from it? The complexity of Professor Jennison's apparatus goes some way to mask a well-known principle, the multistage phase-shift oscillator. With two stages we have the multivibrator, but with three or more a near sine-wave generator may result. The diagram shows a 3-stage RC oscillator, or should it be more properly a 3-ph generator? That depends on the purpose to which it is put. Clearly, if it is used in its 3-ph capacity, it will have when mechanically stationary, an associated rotating field. That field can be stopped by suitable mechanical rotation but can we draw any conclusions about field and charge from that?

If indeed we wish to freeze a travelling wave on a transmission line, then it is in

principle easier to adopt the proposal in the letter from R. J. Hodges, also in the August issue. Admittedly that pattern came from a pulse generator at the left hand end of the line, but it could just as easily have come from energy received by an aerial.

As for all that 3K stuff, that is just confusion worse confounded.

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## TECHNOLOGY AND PEOPLE

Those who have read Prof. H. J. Campbell's most excellent book *The Pleasure Areas* (Eyre Methuen) will be fully aware that the analogy between electronics and the brain is very much stronger than a mere apperency: Campbell, a neurophysiologist of no mean standing, makes it clear that everything we do is done ultimately for stimulation of the pleasure areas which have evolved out of the "smell brain" of the fish.

Apparently there is stimulation from the peripheral receptors (broadly the senses): there is stimulation from the movement of muscles: and above all, there is stimulation from the thought processes at work in the vast neo-cortex that makes us different to the lesser beasts.

This latter point is where the importance comes in of the pyramid programme which I mentioned in my letter of February this year — it provides a very wide base of information wherefrom an entry into genuine abstraction becomes possible, whereas that entry is impossible from a narrow specialistic base simply because the subject does not have enough information to think about, i.e. to compare: indeed the "research" of a genuine specialist tends to be little more than a good old grope in the dark!

Obviously, the more information one has to think about the more interested one becomes in systems outside one's animalistic self: Adam was more like a wasp that will not be taught to keep out of the marmalade: Cain killed Abel to appease his own introvert jealousy: Lamech's ego caused him to think that he could dispose of whom he wished. On the other hand, Noah may be thought of as the first extrovert creative, not only saving the animals two by two, but planting the first vineyard and then, sadly, imitating a newt! Obviously he still had some interest in his own material pleasures.

To put it plainly, Noah was the first to get some way into the abstract with due stimulation of his frontal lobes. Campbell makes it clear that this stimulation is *electrical*, and electrical activity in the brain is the one sure sign of remaining life.

Action, the verb of the sentence, has

